Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US05/001884

International filing date: 21 January 2005 (21.01.2005)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/537,889
Filing date: 22 January 2004 (22.01.2004)

Date of receipt at the International Bureau: 21 February 2005 (21.02.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

1285629

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

February 15, 2005

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *60/537,889*
FILING DATE: *January 22, 2004*
RELATED PCT APPLICATION NUMBER: *PCT/US05/01884*

Certified by

Jon W. Dudas

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Please type a plus sign (+) inside this box → [+]

Revised PTO/SB/16 (8-00)
Approved for use through 10/31/2002. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Attorney Docket No. 30795-200443

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

INVENTOR(S)		
Given Name (first and middle (if any))	Family Name or Surname	Residence (City and either State or Foreign Country)
Peter S.	Atherton	Leesburg, VA

☐ *Additional inventors are being named on the _____ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

A LOW COST RADIO FREQUENCY IDENTIFICATION TAG

CORRESPONDENCE ADDRESS

Direct all correspondence to:

☒ Customer Number 26694 → *26694* 26694 PATENT TRADEMARK OFFICE

OR *Type Customer Number here*

☒ Firm or Individual Name	VENABLE LLP				
Address	P.O. Box 34385				
Address					
City	Washington	State	DC	ZIP	20043-9998
Country	U.S.A.	Telephone	202.344.4000	Fax	202.344.8300

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 8 ☐ CD(s), Number

☒ Drawing(s) *Number of Sheets* 3 ☐ Other (specify)

☒ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

FILING FEE AMOUNT ($)

☒ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 22-0261

☐ Payment by credit card. Form PTO-2038 is attached.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☐ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____.

Respectfully submitted,

SIGNATURE _____ Date 1/22/04

TYPED or PRINTED NAME Jeffri A. Kaminski REGISTRATION NO. *(if appropriate)* 42,709

TELEPHONE 202-344-4800 Docket Number: 30795-200443

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51, and is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. SEND TO: **Box Provisional Application**, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

VENABLE

PTO/SB/17 (10-01)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2004

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 160

Complete If Known	
Application Number	
Filing Date	January 22, 2004
First Named Inventor	Peter S. Atherton
Examiner Name	
Group / Art Unit	
Attorney Docket No.	30795-200443

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 22-0261

Deposit Account Name:

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☒ Payment Enclosed:

☒ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	160

SUBTOTAL (1) ($) 160

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims		- ** =	0	X		=	0
Independent Claims		- ** =	0	X		=	0
Multiple Dependent				X		=	0

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2204	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2215	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2010	2255	1005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,330	2453	665	Petition to revive – unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	25403	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17 (q)	
1808	180	1808	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 0

SUBMITTED BY

Complete *(if applicable)*

Name (Print/Type)	Jeffri A. Kaminski	Registration No. Attorney/Agent)	42,709	Telephone	202-344-4800
Signature				Date	1/22/04

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SEND TO: Commissioner for Patents, Mail Stop Patent Application, Alexandria, VA 22313-1450.

VENABLE ATTORNEYS AT LAW

PC Docs No. 2/517202

Provisional Patent Specification for the Invention Entitled:

A Low Cost Radio Frequency Identification Tag

Inventor: Peter Samuel Atherton
Address: 43811 Water Bay Terrace
Leesburg Virginia 20176 USA

This document contains 8 pages of text and 3 pages of figures.

Background to the Invention

Radio frequency identification (RFID) labels and tags are expected to enable the next generation of automated item identification technology. (In this document the terms "label" and "tag" are used interchangeably.) In particular it is expected that self-adhesive RFID labels and tags will be used extensively to tag items and containers.

In order for RFID tagging to be widely adopted it will need to be low-cost. The current conventional means of providing self-adhesive RFID tags involves producing discrete RFID tags that each includes all of the components needed to provide a complete RFID capability, and applying such tags to the items to be tagged. A disadvantage of this approach is that the production of complete, discrete RFID tags is intrinsically costly.

Disclosure of the Invention

The object of the current invention is to overcome or substantially ameliorate the above disadvantage.

There is disclosed herein a method for providing a low cost radio frequency identification (RFID) capability for an item, said method comprising:

- an item to be provided with an RFID capability;
- application of a radio frequency (RF) antenna directly to said item, preferably but not necessarily by printing said RF antenna on said item;
- an RFID electronics module that is provided separately from said item and said RF antenna;
- said RFID electronics module containing RFID electronics that provide an RFID capability when electrically coupled to said RF antenna;
- said RFID electronics module including a means to be applied to said item so as to be electrically coupled to said RF antenna on said item;
- application of said RFID electronics module to said item in a manner so as to couple said RFID electronics module to said RF antenna and thereby provide an RFID capability for said item.

Brief Description of the Figures

The principles of the present invention will now be described by way of non-limiting example with reference to the schematic illustrations in figures 1 to 3, wherein:

- Figures 1 and 2 are schematic illustrations of the essential features of a preferred embodiment of the current invention, showing an item with a pre-applied RF antenna and an RFID electronics module being applied to the item in the vicinity of said RF antenna so as to couple to said RF antenna and thereby provide a complete RFID function for said item;
- Figure 3 is a schematic illustration of one preferred embodiment of the RFID electronics module illustrated in figures 1 and 2.

Detailed Description of the Invention

In general an RFID tag provides the capability to store data electronically and to enable the stored data to be read from a distance by means of radio frequency (RF) techniques. In some cases an RFID tag may enable modification of said stored data.

An RFID tag consists of two distinct components:

- an RF antenna; and
- RFID electronics that are coupled to said RF antenna to provide an RFID capability.

In a conventional RFID tag both the RF antenna and the RFID electronics are integrated into the tag at the time of manufacture of the tag, so that the tags are produced as discrete, fully functional RFID devices that are applied to items to be tagged.

The basic concept underlying the present invention is that the RF antenna portion and the RFID electronics portion of an RFID tag are produced separately and assembled on the item to be tagged, the primary objective being to reduce the overall cost of the RFID tagging process (although other benefits do also accrue). Specifically, in the present invention the RF antenna is pre-applied to an item that is to be tagged and the RFID

electronics is applied separately to the item in the form of a discrete RFID electronics module that couples to the pre-applied RF antenna to provide an RFID capability for said item.

It should be appreciated that the term "item" as used herein is used in its broadest sense, and may for example refer to a product or product packaging.

The pre-applied RF antenna has no RFID capability in its own right, before the RF electronics module is applied.

Preferably, but not necessarily, the pre-applied RF antenna will be applied to an item by means of a printing process that may in one embodiment involve printing electrically conductive ink directly onto the surface of said item. Printing of said electrically conductive ink may be carried out in conjunction with printing of graphics, text, barcodes or other visible markings on said item.

It should be appreciated that in other embodiments the RF antenna may be made from materials other than electrically conductive inks. For example, in one embodiment the RF antenna may be made from a solid metal conductor or from a hybrid ink-plus-metal conductor.

Preferably, but not necessarily, the RFID electronics module will couple to the pre-applied RF antenna by means of a non-contact coupling method such as capacitive coupling or inductive coupling.

Figures 1 and 2 are schematic illustrations of one embodiment of the present invention. In the embodiment of figures 1 and 2 an item 101 has an RF antenna 102 printed on it. An RFID electronics module 103 is subsequently applied to the item 101 in a specified position and orientation in the vicinity of the RF antenna 102 such that the RFID electronics in the module 103 couples to the RF antenna 102 to provide an RFID capability for the item 101. Figure 1 shows the RFID electronics module 103 before application to the item 101, while figure 2 shows the RFID electronics module 103 after

it has been applied to the item 101. In figures 1 and 2 the RFID electronics module 103 is shown as having a circular shape, but it should be appreciated that other shapes and configurations for the RFID electronics module 103 are possible, while still embodying the principles described herein for the present invention. Similarly, a specific RF antenna design 102 is illustrated in figures 1 and 2, but it should be appreciated that other RF antenna designs are possible, including induction loop designs for the RF antenna 102.

Preferably, but not necessarily, the RFID electronics module 103 will be applied to the item 101 by means of an adhesive layer on the RFID electronics module 103.

The RFID electronics in the RFID electronics module 103 may be either "passive" or "active". In this context the term "passive" means that the RFID electronics module 103 does not include a power source, while the term "active" means that the RFID electronics module 103 includes an on-board power source such as a battery.

In one preferred embodiment the RFID electronics module 103 is passive and the electronics in the module 103 comprises a single RFID integrated circuit (IC) connected to electrically conductive pads that enable non-contact coupling between the RFID electronics module 103 and the pre-printed antenna 102.

In the embodiment of figures 1 and 2 the RFID electronics module 103 preferably couples to the RF antenna 102 by means of a non-contact coupling method such as capacitive coupling or inductive coupling.

Figure 3 is a schematic illustration of one preferred embodiment of the RFID electronics module 103. In figure 3 the RFID electronics module 103 consists of a substrate 301 to which is attached an RFID IC 302. The RFID IC 302 is connected to electrically conductive pads 303 that enable non-contact coupling between the RFID electronics module 103 and the pre-printed antenna 102. The substrate 301, RFID IC 302 and electrically conductive pads 303 may be covered with a layer of adhesive that is used to attach the RFID electronics module 103 to the item 101. In one embodiment the substrate 301 may be a thin flexible substrate material, while in another embodiment

the substrate 301 may be a thicker material with recessed or contoured portions to house the RFID IC 302 and electrically conductive pads 303.

In a variation on the embodiment of the RFID electronics module 103 illustrated in figure 3, the RFID IC 302 may be designed to enable non-contact coupling to the RF antenna 102 without the need for electrically conductive pads 303, in which case the electrically conductive pads 303 will not be included in the RFID electronics module 103.

The use of non-contact coupling between the RFID electronics module 103 and the pre-printed RF antenna 102 avoids the need to establish a direct electrical connection between the RFID electronics module 103 and the pre-printed RF antenna 102, thereby making assembly of the RFID electronics module 103 on the item 101 easier. In order to enable or optimize non-contact coupling it may be necessary to apply a layer of dielectric material between the RF antenna 102 and the RFID electronics module 103, for example by printing said dielectric material over the RF antenna 102. In those embodiments where the RFID electronics module 103 is applied to the item 101 by means of an adhesive layer said adhesive layer may provide a suitable dielectric layer between the RF antenna 102 and the RFID electronics module 103.

In some embodiments non-contact coupling between the RF antenna 102 and the RFID electronics module 103 may occur through a substrate material that is part of the item 101, so that the RF antenna 102 may be on one surface of a substrate material and the RFID electronics module 103 may be applied to the opposite surface of said substrate material. For example, the RF antenna 102 may be printed on the inside surface of a product package and the RFID electronics module 103 may be applied in a specified position and orientation to the outside surface of said product packaging such that the RF antenna 102 couples to the RFID electronics module 103.

It should be appreciated that in order for non-contact coupling between the RF antenna 102 and the RFID electronics module 103 to be effective it is necessary for the RFID electronics module 103 to be placed on the item 101 in a specified position and orientation relative to the RF antenna 102, within certain tolerances. Preferably, but not

necessarily, the non-contact coupling means may be designed so as to allow some misalignment of the RFID electronics module 103 and the RF antenna 102 while still providing effective non-contact coupling and an effective RFID capability. For example, in the case of capacitive coupling between electrical contact pads on the RF antenna 102 and electrical contact pads on the RFID electronics module 103, one set of contact pads – either on the RF antenna 102 or on the RFID electronics module 103 – may deliberately be made significantly larger than the other set and the contact pads may be spaced so as to allow a degree of misalignment of the RFID electronics module 103 relative to the RF antenna 102 while still providing effective capacitive coupling.

In one preferred embodiment the item 101 may include alignment marks to indicate where and how the RFID electronics module 103 should be placed to result in effective non-contact coupling to the RF antenna 102. In another preferred embodiment the item 101 may include surface features, such as a recessed area of specified size and shape, to aid in positioning of the RFID electronics module 103 on the item 101 and thereby produce effective non-contact coupling to the RF antenna 102. Similarly, the RFID electronics module 103 may include markings or colors to assist in applying the RFID electronics module 103 to the item 101 in the correct position and orientation so as to produce effective non-contact coupling between the RFID electronics module 103 and the RF antenna 102.

In some applications it may be important that the RFID electronics module 103 cannot be removed from an item 101 and reused on another item. Hence in some preferred embodiments the RFID electronics module 103 may be designed such that it will be damaged if it is removed after being applied to an item 101, thereby preventing the RFID electronics module 103 from being reused on another item. This self-destruct feature may result from (i) using a strong adhesive to attach the RFID electronics module 103 to the item 101; or (ii) including in the design of the RFID electronics module 103 certain weak points that are intended to break or separate or fail in some way if the RFID electronics module 103 is removed from the item 101; or (iii) other deliberately introduced design element(s) that result in damage to the RFID electronics module 103 if it is removed from the item 101.

In some applications it may be desirable for the RFID electronics module 103 to be easy to remove. For example, there are at present privacy concerns among some consumer groups that RFID may be used as a tracking mechanism after an item is purchased, so it may be desirable to provide consumers an easy way to disable the RFID capability on any tagged items that they purchase. In the context of the present invention this could be achieved by allowing easy removal of the RFID electronics module 103 from the item 101, and in some embodiments designing the RFID electronics module 103 to be damaged and therefore unusable after it has been removed from the item 101.

END

Inventor: Peter Atherton
Title of Invention: A Low Cost Radio Frequency Identification Tag
Attorney Docket No.: 30795-200443
VENABLE

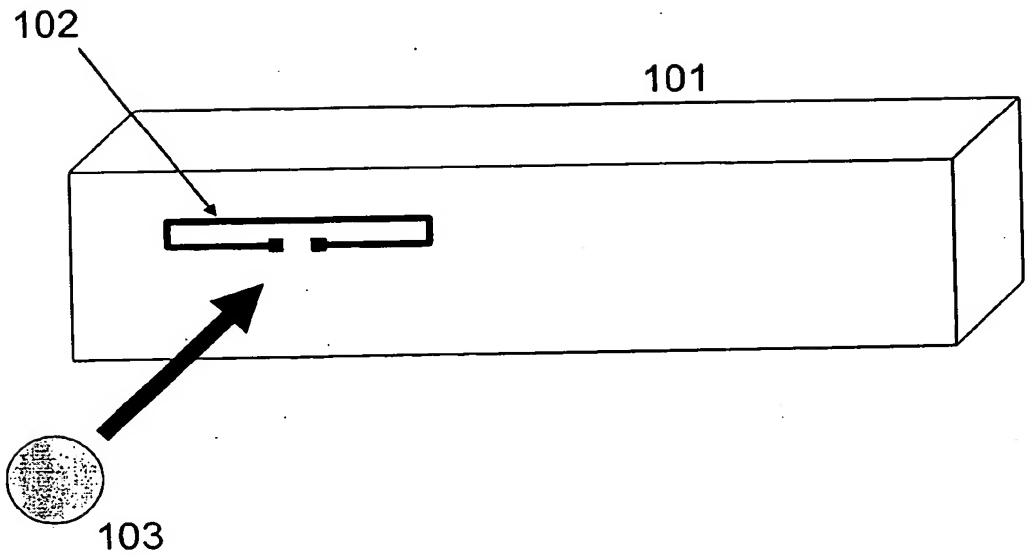

FIGURE 1

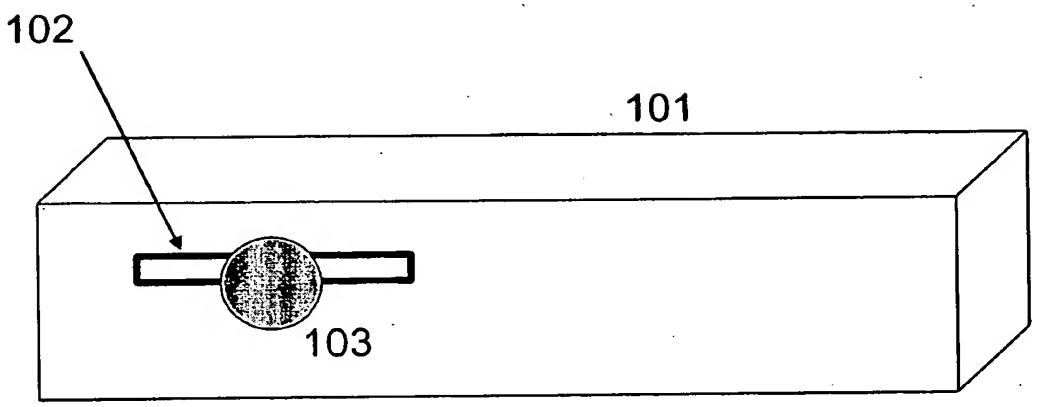

FIGURE 2

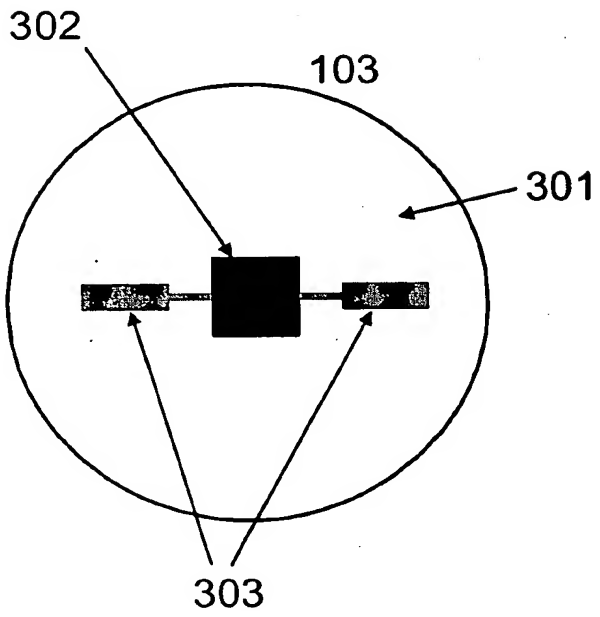

FIGURE 3